REMARKS

Status of Claims

Claims 1-7 and 10 are pending in the application.

Response to Amendment

The amendment filed 9/25/2009 is objected to under 35 U.S.C. §132(a). Explosive vaporization of the coating material is stated in the abstract and paragraph [0004] of the specification however, it is never stated that the protrusion is sufficient to prevent explosive vaporization.

In response, Applicants respectfully submit that the specification teaches that:

(a) explosive vaporization of coating material sandwiched between sheets being welded is a well known problem,

(b) provision of spacers to allow escape of vapors produced during welding is a well known method for prevention of explosive vaporization,

(c) provision of spacers is time consuming,

(d) the present invention allows rapid formation of topographic changes, thereby permitting a reduction in the machining time by a factor of 10 without reducing the quality of the machining [Abstract].

Thus, it follows from this disclosure that the objective of the present invention is provision of spacers for prevention of explosive vaporization, and that the invention provides an improved method for producing spacers. Thereby, explosive vaporization is prevented using known spacers, but laser machined by an improved, much more rapid technique.

Nevertheless, in view of the requirement to delete the language "explosive vaporization" from claim 1, to expedite allowance, Applicants delete the objected to language and replace it with the language found in paragraph [0015] of the specification as published "...the at least one protruding topographical change causes the formation of at least one gap between the at least two sheets, and that the at least two sheets, in the region of the at least one gap, are welded together in such a way that <u>vaporization products formed in the process can escape into the at least one gap</u>. The escape facility for the vaporization products ensures a substantially higher quality of weld seam." By allowing escape of vaporization products,

the claimed method prevents explosive vaporization, which occurs when the vaporization products are trapped.

Applicants also delete the "explosive vaporization" language from claim 3.

Regarding claim 7, the Examiner objects to the language "to stop when the topographical change protrudes from the sheet."

In response, Applicants delete the objected to language, leaving the language that is explicitly supported by the specification.

Claim Rejections - 35 USC § 112

Claims 1-7 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. . From claim 1: "... sufficient to prevent explosive vaporization of the coating material ...." In Claim 7: "to stop when the topographical change protrudes from the sheet."

In response, Applicants delete the objected to language from the claims.

Claim 2 is rejected under 35 U.S.C. 112, second paragraph, in that there is insufficient antecedent basis for, "the focal area" recited at line 3.

In response, Applicants amend claim 2 to provide antecedent basis. Support is inherent in paragraph [0012] of the specification as published.

Claim Rejections - 35 USC §102(b)

Claims 1, 3-6 rejected under 35 U.S.C. §102(b) as being anticipated by FUJIMOTO et al (JP 2002478178 A cited by applicant) as evidence by Dunsky et al (US 2001/0045419). Fujimoto et al teaches (re claim 1, 3 and 6) a laser lap welding method in which ***a protrusion 2a is formed***, by melting, ***on the surface of sheet 2 facing away from laser 1.***

According to the Examiner, the narrowing spiral of the laser beam is merely an inherent characteristic, shown by Dunsky et al (US 2001/0045419) See Figs. 21, 22, 32. which all show a narrowing spiral weld pattern.) The narrowing spiral limitation of claims 1 and 3 is merely a design choice and it is well known in the art that the laser can be moved in a narrowing spiral during machining or welding.

Applicants respectfully traverse. Fujimoto et al may show laser formation of a protrusion 2a on the ***back surface*** of a sheet, but do not show movement of the laser in a spiral. That which is missing from Fujimoto et al is not provided by the ***hole forming*** laser

machining of Dunsky et al. Those working in this art would not look to a reference teaching forming holes to modify a reference teaching forming of a protrusion on a back surface, thus these references are not combinable.

Dunsky et al position a laser beam, having a small area 294, in sequential contiguous overlapping locations around a periphery 292, or move the beam continuously through each location at a speed, sufficient for the system to deliver a number of beam pulses necessary to achieve the depth of a ***cut*** at the location to form ***through- holes*** 272c (Fig. 21; specification para [0108]), 272d (Fig. 22). Thus, Dunsky et al teach moving the laser to cut a large hole in a sheet. There is no mention of moving the beam in a narrowing spiral pattern in such a manner to produce a protrusion.

In paragraph [0122] and Fig. 32 Dunsky et al describe forming a hole by moving a laser beam in a spiral ***beginning more out of focus at the center, and becoming more focused as it reaches the outer spiral section.*** Thus, the beam describes an ***expanding*** spiral, not a narrowing spiral.

A critical limitation recited in claims 1 and 3 is "generating … at least one topographical change protruding from the surface by directing the laser beam onto the sheet and ***guiding the laser beam to describe a <u>narrowing</u> spiral***." As explained in paragraph [0014] of the specification as published: "It is also advantageous if the laser beam is guided by the scanner device in such a way that it describes about the center of its machining area a narrowing spiral. This allows, especially in the case of shoot-through machining, ***more even fusion or melting and cooling processes and thus the formation of a topographical change in the form of an evenly contoured elevation.*** As disclosed in paragraph [0020]: "The laser beam is guided by the scanner device in such a way that it describes about the center of its machining area a narrowing spiral. … As a result of the spiral movement from outer to inner, a more even formation of the topographical change on that side of the sheet facing away from the laser is realized, in the form of an evenly contoured mountain." Thus, by means of the present invention, protrusions can be formed in a predictable, controllable, reliable manner on either the front or back surface of the sheet. The prior art does not teach forming the protrusions reliably reproducibly by movement of the laser in a decreasing spiral pattern.

Regarding Claim 5, Fujimoto et al teaches a protrusion on the side facing the laser and the side facing away from the laser as shown in drawing 3.

Applicants do not concede that Fig. 3 of Fujimoto et al show protrusions. The English abstract merely mentions protrusion 2a on the back surface of the sheet. In any case, the present invention has the objective of providing a protrusion for formation of a gap between sheets sufficient to permit escape of vaporized coating material. If a protrusion is formed on the front of the sheet of Fig. 3 of Fujimoto et al, it is not provided for forming a gap as it is on the side away from the facing surfaces of the sheets.

Accordingly, Fujimoto et al do not teach directing a laser beam onto the sheet and guiding the laser beam to describe ***a narrowing spiral.*** Fujimoto does not teach any movement of the laser while creating the protrusion, especially spiral movement is never mentionend. Fujimoto et al uses a standard laser pulse. Without melting through, and without the narrowing spiral pattern, an insufficient protrusion height is achieved to allow complete escape of vaporized coating material during welding together of two sheets. While the English language abstract of Fujimoto et al mentions a gap, the reason for the gap is not specified, there may be some escape of gasses, but there is no teaching that the gap is of a sufficient height to allow escape of vaporized gasses.

Fujimoto paragraph [0021] teaches protrusions which reach a height of 30 µm. In contrast, the protrusions formed in accordance with the present invention, by movement of the laser in a decreasing spiral, achieve heights of normally 250 µm, a height sufficient to prevent explosive vaporization. In any case it must be appreciated that ***the superior height*** of the protrusions of the present invention, ***directly attributed to the narrowing spiral pattern*** of the laser, provide a superior gap or spacing to prevent the problem of explosive vaporization.

Thus, the present method "narrowing spiral" showed significantly different results as the standard method "pulsed laser" of Fujimoto et al. Applicants in fact conducted experiments and presented the results showing that the present method results in protrusions with a medium height of approx. 250 µm while the standard method (Fujimoto et al) results in protrusions with a medium hight of approx. 40 µm.

Since neither Fujimoto et al nor Dunsky et al teach movement of a laser in a decreasing spiral to form a protrusion, these references individually or in combination do not teach every limitation of the present claims, thus do not anticipate.

Withdrawal of the rejection is respectfully requested.

Claim Rejections - 35 USC § 103

Claims 2 is rejected under 35 U.S.C. §103(a) as being unpatentable over Fujimoto et al in view of Milewski et al (US Patent No. 5.760,365).

In response, Applicants submit that claim 2 is patentable by virtue of it's dependency from allowable claim 1.

Claim 7 is rejected under 35 U.S.C. §103(a) as being unpatentable over Fujimoto as evidence by Dunsky et al (US 2001/0045419) in view of Leong et al (US Patent No. 6,329,635).

According to the Examiner, Fujimoto et al as evidence by Dunsky et al discloses substantially all features of the claimed invention as set forth above except for the-melting through is controlled by pre- specifying a processing time or by providing a penetration sensor which regulates the laser machining time, and Leong et al teach a method for welding and laser heat treatment monitoring which involves determining depth penetration wherein the machining time can be controlled in term of a calibration curve.

Applicants respectfully traverse.

As discussed above, Fujimoto et al pulses a stationary laser to melt part way through a sheet. Dunsky et al move a laser while cutting through and forming large holes in a sheet. These references can not be combined, and even if read together do not provide suggestion for the present invention as claimed in claim 7.

Since the two main references do not teach movement in a spiral to form a topographic change, the additional limitations of the calibration curve to pre-specify the processing time as taught by Leong et al have no relation to, and can not be combined with, the two main references to reach the present invention.

The narrowing spiral of the laser path is the most important limitation of the present claims and is responsible for the formation of the superior protrusion. The Examiner has not provided any reason to suspect that Fujimoto ***inherently*** employs such an unconventional technique.

The Examiner's interpretation of Dunsky et al is also without support and is factually in error. Dunsky et al do teach in Fig. 32 a widening spiraling profile 299a for reducing sidewall taper of the hole formed in the sheet. The discussion relating to Fig. 32 concerns ablation (removal) of a wider area in the center of the machining area and less area at the outer spiral section (paragraph [0122]). This has no relevance to the present invention.

Dunsky does not teach a ***narrowing*** spiral as already discussed in the prosecution history. This critical fact has been ignored by the Examiner. A widening spiral as in Dansky et al will not get a protrusion but a through hole and without any spiral as in Fujimoto you may get a protrusion but a much lower one as our one.

Further, Dunsky et al relates to laser micromachining and, in particular, to a method and apparatus employing a single pass actuation (SPA) assembly to vary the power density of ultraviolet laser output applied to a target surface during processing of multilayer workpieces having at least two layers with different absorption characteristics in response to ultraviolet light. Dunsky et al form "vias" (holes) or "blind vias" in electronic materials.

Those of ordinary skill would not be able to take the Dunsky discussion associated with Fig. 32 and concerning ablation (removal) of a wider area in the center of the machining area and less area at the outer spiral section (paragraph [0122]) to form a tapering hole, and translate this into forming a topographic projection on one side or the other of a sheet. Thus, the teaching of Dunsky et al does not relate to the present invention and the references can not be combined in the manner proposed by the Examiner.

Dunsky et al nowhere teach forming topographical changes projecting from a surface of a coated metal sheet in preparation for welding. If one were to apply the teaching of Dunsky et al to a coated metal sheet, one would not produce a spacer having the present shape. A widening spiral as taught by Dunsky et al would not produce the same shape as a decreasing spiral as presently claimed.

Those working in this art would not find within these references suggestion for combining these references, and employing a decreasing spiral technique to form topographical changes projecting from a surface of a sheet, on either the side facing the laser or the side opposite the laser, to make the present invention.

The present invention addresses and solves the problem of (a) speed and (b) gap width. With the present invention, a laser scanner is used for guiding the does not have to be positioned over the individual topographical changes, but can advantageously be guided on an optimized path between the topographical changes. These differences result in very different necessary machining times: using a laser scanner, it is possible to generate 30 suitable topographical changes in about 0.3 seconds; a conventional system requires about 10 times the machining time. This result is not obvious from the cited references.

Accordingly, withdrawal of the rejection and early issuance of the Notice of Allowance is respectfully requested. Should further issues remain, the Examiner is respectfully requested to contact the undersigned at the indicated telephone number.

The Commissioner is hereby authorized to charge any fees which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment, to Deposit Account Number 16-0877.

Respectfully submitted,

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